7B92

CALIBRATION

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CALIBRATION

Calibration Interval

To assure instrument accuracy, check the calibration of the 7B92 every 1000 hours of operation, or every six months if used infrequently. Before complete calibration, thoroughly clean and inspect this instrument as outlined in the Maintenance section.

TEKTRONIX Field Service

Tektronix, Inc. provides complete instrument repair and recalibration at local Field Service Centers and the Factory Service Center. Contact your local TEKTRONIX Field Office or representative for further information.

Using This Procedure

General. This section provides several features to facilitate calibration of the 7B92. These are:

Performance Check. The performance of this instrument can be checked by performing only the ✓ CHECK steps. The ✓ preceding a step indicates that performing this step checks the instrument against the tolerances listed as a Performance Requirement (see Specification section in Operators manual). Limits and tolerances given in other check steps are calibration guides and should not be interpreted as

instrument specifications. Operator front-panel adjustments are adjusted as part of the Performance Check procedure.

Partial Calibration. A partial calibration is often desirable after replacing components, or to touch up the adjustment of a portion of the instrument between major recalibrations. To calibrate only part of the instrument, set the controls as given under Preliminary Control Settings and start with the nearest Equipment Required list preceding the desired portion. To prevent unnecessary recalibration of other parts of the instrument, readjust only if the tolerance given in the CHECK--part of the step is not met. If readjustment is necessary, also check the calibration of any steps listed in the INTERACTION or CALIBRATION part of the step.

Complete Calibration Procedure. Completion of each step in the complete Calibration procedure insures that this instrument is correctly adjusted and performing within all given tolerances.

TEST EQUIPMENT REQUIRED

General

The following test equipment and accessories, or its equivalent, is required for complete calibration of the 7B92. Specifications given for the test equipment are the minimum necessary for accurate calibration. Therefore, the specifications of any test equipment used must meet or exceed the listed specifications. All test equipment is assumed to be correctly calibrated and operating within the listed specifications. Detailed operating instructions for the test equipment are not given in this procedure. Refer to the instruction manual for the test equipment if more information is needed.

Special Calibration Fixtures

Special TEKTRONIX calibration fixtures are used in this procedure only where they facilitate instrument calibration. These special calibration fixtures are available from Tektronix, Inc. Order by part number through your local TEKTRONIX Field Office or representative.

Calibration Equipment Alternatives

All of the listed test equipment, or its equivalent, is required to completely check and adjust this instrument. The Calibration procedure is based on the first item of equipment given as an example of applicable equipment. When other equipment is substituted, control settings or calibration setup may need to be altered slightly to meet the requirements of the substitute equipment. If the exact item of test equipment is not available, first check the Specifications column carefully to see if any other equipment is available which might suffice.

TEST EQUIPMENT

Description	Minimum Specifications	Examples of Applicable Equipment
1. Calibration Oscilloscope	TEKTRONIX 7000 Series. 500 megahertz bandwidth.	a. TEKTRONIX 7904 Oscilloscope.
2. Amplifier Plug-In Unit	TEKTRONIX 7A-Series. 50 millivolts, five volts deflection factor.	a. 7A15A, 7A16, 7A18. b. Other 7A-Series plug-in units may be used.
3. Wide-Band Amplifier Plug-In Unit	TEKTRONIX 7A-Series. 500 megahertz bandwidth.	a. TEKTRONIX 7A19 Amplifier.
4. 10X Passive Probe	Compatible with 7A-Series Amplifiers.	a. TEKTRONIX P6053 Probe.
5. Differential Sampling System	System risetime at least 350 picoseconds pulse amplitude, 200 millivolts input, differential sensitivity, 100 millivolts and 200 millvolts.	a. TEKTRONIX 7S12 TDR/ Sampler plug-in Unit with S1 Sampling Head and S-52 Pulse Generator Head, and a 7S11 vertical sampling plug-in unit with a S1 Sampling Head.
6. Fast-Rise Pulse Generator	Pulse output; positive-going pulse with 200 millivolts amplitude. Risetime equal to or less than 70 picoseconds.	a. TEKTRONIX Type 284 Pulse Generator.
7. Time-Mark Generator	Marker outputs, two nanoseconds to 0.5 second; marker accuracy, within 0.1%.	a. TEKTRONIX 2901 Time-Mark Generator. b. TEKTRONIX Type 184 Time-Mark Generator.
8. Low-Frequency Sinewave Generator	Frequency, 30 hertz to 50 hertz; output amplitude, variable from 50 millivolts to 10 volts.	a. General Radio 1310-B Oscillator.
9. Medium-Frequency Constant Amplitude Signal Generator	Frequency, 20 megahertz to 100 megahertz; output amplitude variable from 100 millivolts to 500 millivolts.	a. TEKTRONIX Type 191 Constant Amplitude Signal Generator.

TEST EQUIPMENT (cont)

Description	Minimum Specifications	Examples of Applicable Test Equipment
10. High-Frequency Constant Amplitude Signal Generator	Frequency, 100 megahertz to 500 megahertz; reference frequency, 10 megahertz or lower; output amplitude, variable from 0.5 to four volts; amplitude accuracy, constant within 1% of reference as output frequency changes.	a. TEKTRONIX 067-0532-01 Calibration Fixture. b. TEKTRONIX 067-0650-00 Calibration Fixture. c. General Radio 1362 UHF Oscillator with 1263-C Amplitude-Regulating Power Supply. d. Wiltron Model 610B Swept Frequency Generator with Model 61083, 10 to 1220 megahertz plug-in.
11. Plug-In Extender	Provides access to 7B92 adjustments.	a. TEKTRONIX 067-0589-00 Calibration Fixture.
12. Attenuator	Impedance, 50 ohms; attenuation, 5X; connector GR874.	a. TEKTRONIX Part No. 017-0079-00.
13. T-Connector	Connectors, BNC.	a. TEKTRONIX Part No. 103-0030-00.
14. Cable (Three Required)	Impedance, 50 ohms; type RG-58/U; length, 42 inches; connectors, BNC.	a. TEKTRONIX Part No. 012-0057-01.
15. Adapter	Connectors, GR874 and BNC male.	a. TEKTRONIX Part No. 017-0064-00.
16. Adapter (Two Required)	Connectors, GR874 and BNC female.	a. TEKTRONIX Part No. 017-0063-00.
17. Adapter (Two Required)	Connectors, BNC female and BNC female.	a. TEKTRONIX Part No. 103-0028-00.
18. Adapter	Connectors, BSM male and BNC female.	a. TEKTRONIX Part No. 103-0036-00.
19. Screwdriver	Three-inch shaft, 3/32 inch bit.	a. Xcelite R-3323.
20. Low Capacitance Screwdriver	1-1/2 inch shaft.	a. TEKTRONIX Part No. 003-0000-00.

Preliminary Procedure

1. Install the 7A19 Amplifier unit into the Left Vert compartment of the 7904 Oscilloscope.

2. Remove the side covers from the 7B92 and install it into the 067-0589-00 plug-in extender. Install the 7B92 and the plug-in extender into the B Horiz compartment of the 7904 Oscilloscope.

3. Remove the right side panel from the 7904 Oscilloscope.

4. Turn on the oscilloscope and allow at least 20 minutes warmup before proceeding with calibration.

5. Set the oscilloscope system controls as follows:

7904 Oscilloscope

Vertical Mode	Left
B Trigger Source	Vert Mode
A Trigger Source	Vert Mode
Horizontal Mode	B
Focus	Adjust for well defined display
Intensity	As desired
Grat Illum	As desired

TRIGGER SYSTEM CALIBRATION

1. 7904 Oscilloscope
2. 7A19 Amplifier
3. 7A15A Amplifier
4. Plug-in Extender
5. 10X probe
6. Low-frequency sinewave generator
7. Constant amplitude signal generator (20 megahertz output)
8. Constant amplitude signal generator (100 to 500 megahertz).
9. 42-inch 50-ohm BNC cable (two)
10. BNC T-connector
11. GR to BNC female adapter
12. GR to BNC male adapter
13. GR 5X attenuator

Control Settings

Perform the Preliminary Procedure at the beginning of this section

NOTE

If the 7B92 has been operating satisfactorily and it is desired to touch up instrument calibration for improved performance, complete steps 1(a) and 1(b), then proceed to calibration step 2. If the instrument has known operating problems, perform calibration steps 1(a) through 1(k), and then continue with calibration step 2.

7B92 Time Base

Main Triggering	
SLOPE	(+)
MODE	AUTO
COUPLING	AC
SOURCE	INT
TERM	OUT - 50Ω
Delayed Triggering	
SLOPE	(+)
COUPLING	AC
SOURCE	INT
LEVEL	IN - RUNS AFTER DLY TIME
DELAY TIME MULT	0.00
TIME/DIV OR DLY TIME	20 µs
DLY'D Time/Division	10 µs (pull out for INTEN Display Mode)
VARIABLE	CAL (press in)
Variable Selector (Internal)	Delaying Sweep Variable (see Operators Manual)
POSITION	For centered display
ALT	(press in)

7A19 Amplifier

Position	Midrange
Volts/Div	50 mV
Polarity	+Up
Input Coupling	DC

1. Preliminary Trigger Adjustments (R740, R750, R940, R950, and R364).

a. Connect the low-frequency sinewave generator to the 7A19 Input with a 42-inch 50-ohm BNC cable and BNC T-connector. Connect the output of the T-connector to the MAIN TRIG IN connector with a 42-inch BNC cable.

b. Set the low-frequency sinewave generator for a two-division display at 50 kilohertz. Center the display vertically.

c. Remove the 7B92 from the plug-in extender and install the 7B92 directly into the B Horiz compartment.

d. Preset the following control settings

R364	Fully Counterclockwise
R750	Fully Counterclockwise
R940	Fully Counterclockwise
R950	Fully Counterclockwise

e. Rotate the MAIN TRIGGERING LEVEL control for a stable display. If a stable display cannot be obtained, adjust Intensity and Focus control for a well-defined free-running display and set the LEVEL control to the 0 trigger level.

f. ADJUST - R740 Main Arming TD Bias fully counterclockwise, then adjust clockwise until a stable display is obtained. ADJUST - R740 an additional 10 degrees clockwise.

g. Press and release the Delayed Triggering LEVEL control to DLY'D SWP TRIGGERABLE (knob out). Rotate the Delayed Triggering LEVEL for a stable intensified display (do not rotate LEVEL control into SYNC area). Adjust the 7B92 and Oscilloscope Intensity control as necessary for an optimum intensified display.

h. ADJUST - R950 Delayed Sweep Start TD Bias clockwise until the intensified portion of the sweep disappears. ADJUST R950 an additional 10 degrees clockwise.

i. ADJUST - R940 - Delayed Arming TD Bias clockwise until a stable display of the intensified portion of the sweep appears. Rotate the Delayed Triggering LEVEL control as necessary.

j. Press the Delayed Triggering LEVEL control to the (knob in) - RUNS AFTER DLY TIME position.

k. ADJUST - While rotating the DELAY TIME MULT dial, adjust R364, Delay Pickoff TD Bias clockwise until the DELAY TIME MULT dial rotation affects the position of the intensified portion of the display.

l. Remove the 7B92 from the oscilloscope and install the 7B92 into the 067-0589-00 Plug-in extender. Install the 7B92 and the Plug-in extender into the B Horiz compartment.

2. Check/Adjust Main Trigger Level Sensitivity (R730)

a. Set the DELAY TIME MULT dial to 5.00.

b. CHECK - Rotate the MAIN TRIGGERING LEVEL control and check that the delaying sweep (non-intensified portion of display) can be triggered at any point along the positive slope of the waveform.

c. ADJUST - R730 Trigger Level Sensitivity to trigger the display (start of sweep) at any point along the positive slope of the waveform.

d. Change the MAIN TRIGGERING SLOPE switch to (-) and repeat steps b and d for the negative slope of the waveform.

3. Check/Adjust Main Triggering Internal and External DC Centering (R647, R602).

a. Set the low-frequency sinewave generator for a 0.5 division display at 50 kilohertz. Vertically center the display.

b. Change the MAIN TRIGGERING MODE switch to NORM and rotate the MAIN TRIGGERING LEVEL control for a stable display with the trigger point near the vertical center of the waveform (TRIG light on). Note the position of the sweep trigger point (start of non-intensified portion of sweep) with respect to CRT center.

c. Set the MAIN TRIGGERING COUPLING to DC.

d. CHECK - CRT for a triggering display with the position of the sweep trigger point the same as in part b.

e. ADJUST - R647 Internal DC Centering for a triggered display with the position of the sweep trigger point the same as noted in part b.

f. Repeat the adjustment of R647 as necessary until the position of the sweep trigger remains the same in either the AC or DC positions of the MAIN TRIGGERING COUPLING switch. Return the COUPLING switch to AC.

g. Change the MAIN TRIGGERING SLOPE switch to (+). Repeat steps b through f for the positive slope of the waveform.

h. Set the low-frequency sinewave generator for a two-division display (100mV). Vertically center the display.

i. Rotate the MAIN TRIGGERING LEVEL control for a stable display with the trigger point of the non-intensified portion of the display near the center of the waveform. Note the position of the sweep trigger point with respect to CRT center.

j. Set the MAIN TRIGGERING SOURCE switch to EXT.

k. CHECK - CRT for triggered display with the position of the sweep trigger point the same as noted in part i.

l. ADJUST - R602 Main External DC Centering for a triggered display with the position of the sweep trigger point the same as noted in part i.

m. Repeat the adjustment of R602 until the position of the sweep trigger point remains the same in either the INT or EXT positions of the MAIN TRIGGERING SOURCE switch. Return the MAIN TRIGGERING SOURCE switch to INT.

n. Change the MAIN TRIGGERING SLOPE switch to (-) and repeat steps i through m for the negative slope of the waveform.

4. Check/Adjust Delayed Trigger Sensitivity (R920)

a. Remove the BNC cable from the MAIN TRIG IN connector and connect it to the DLY'D TRIG IN connector.

b. Change the following control setting:

Main Triggering

MODE	AUTO
LEVEL	Adjust for TRI'G light on
TIME/DIV OR DLY TIME	20 µs
DLY'D Time/Division	10 µs (Press in for DLY'D SWP Display Mode)

c. Press and release the Delayed Triggering LEVEL control and rotate for a triggered delayed sweep display (oscilloscope intensity may need to be increased).

d. CHECK - Rotate the Delayed Triggering LEVEL control and check that display can be triggered at any point along the positive slope of the waveform. CHECK that the display cannot be triggered at either end of the Delayed Triggering LEVEL rotation (the negative end of the DELAYED TRIGGER LEVEL does not include the HF SYNC area).

e. ADJUST - R920 Delayed Trigger Level Sensitivity to trigger the display at any point along the positive slope of the waveform with no display at either end of the Delayed Triggering LEVEL rotation (the negative end of the Delayed Triggering LEVEL control does not include the HF SYNC area).

f. Change the Delayed Triggering SLOPE switch to (-) and repeat steps d and e for the negative slope of the waveform.

5. Check/Adjust Delayed Triggering Internal and External DC Centering (R802).

a. Set the Delayed Triggering COUPLING switch to DC. Rotate the Delayed Triggering LEVEL control to trigger the display near the vertical center of the waveform

b. Note the position of the sweep trigger point with respect to display center.

c. Set the Delayed Triggering SOURCE switch to EXT.

d. CHECK - CRT for triggered display with the position of the sweep trigger point the same as noted in part b.

e. ADJUST - R802, Delayed External DC center, for a triggered display with the position of the sweep trigger point the same as noted in part b.

f. Repeat the adjustment of R802 until the position of the sweep trigger point remains the same in either the INT or EXT positions of the Delayed Triggering SOURCE switch.

g. Set the Delayed Triggering SOURCE switch to INT. Change the Delayed Triggering SLOPE switch to (+) and repeat parts a through f for the positive slope of the waveform.

✓ 6. Check Main and Delayed Low-Frequency Triggering Operation.

a. Disconnect the BNC cable from the DLY'D TRIG IN connector and connect it to the MAIN TRIG IN connector.

b. Change the following control settings:

Main Triggering	
COUPLING	AC
LEVEL	Adjust for TRI'G light on
Delayed Triggering	
SLOPE	(+)
COUPLING	AC
SOURCE	INT
LEVEL	IN - RUNS AFTER DLY TIME
TIME/DIV OR DLY TIME	10 ms
DLY'D Time/Division	5 ms (Pull out for INTEN Display Mode)

c. Set the low-frequency sine-wave generator for a 0.5 division display at 30 hertz.

✓ d. CHECK - Stable CRT display can be obtained with the MAIN TRIGGERING COUPLING switch set to AC, AC HF REJ, and DC for both the (+) and (-) SLOPE (MAIN TRIGGERING LEVEL control may be adjusted as necessary for a stable display).

e. Change the MAIN TRIGGERING SOURCE switch to EXT. Set the low-frequency sinewave generator for a two-division display (100 mV) at 30 hertz.

✓ f. CHECK - Stable CRT display can be obtained with the MAIN TRIGGERING COUPLING switch set to AC, AC HF REJ, and DC for both the (+) and (-) SLOPE (MAIN TRIGGERING LEVEL control may be adjusted as necessary for a stable display).

g. CALIBRATION - If the 7B92 does not meet the requirement given in parts d and f, check the adjustment of the Main Trigger Level Sensitivity (R730 - Calibration step 2).

h. Disconnect the BNC cable from the MAIN TRIG IN connector and connect it to the DLY'D TRIG IN connector.

i. Change the following control settings:

Main Triggering	
LEVEL	TRIG light on
SOURCE	INT
Delayed Triggering	
LEVEL	OUT - DLY'D SWP TRIGGERABLE
SOURCE	EXT
DLY'D Time/Division	Press in for DLY'D SWP Display Mode

✓ j. CHECK - Stable CRT display can be obtained with the DLY'D TRIG COUPLING switch set to AC and DC for both the (+) and (-) SLOPE (DLY'D TRIG LEVEL control may adjusted as necessary for a stable display). It may be necessary to adjust the 7B92 and oscilloscope Intensity controls to view the delayed sweep trace.

k. Change the DLY'D TRIG SOURCE switch to INT.

1. Press the Delayed Triggering LEVEL control to RUNS AFTER DLY TIME (knob inward). Set the low-frequency sinewave generator for a 0.5 division display at 30 hertz. Return the Delayed Triggering LEVEL control to DLY'D SWP TRIGGERABLE (knob out).

✓ m. CHECK - Stable CRT display can be obtained with the Delayed Triggering COUPLING switch set to AC and DC for both the (+) and (-) SLOPE (Delayed Triggering LEVEL control may be adjusted as necessary for a stable display).

n. CALIBRATION - If the 7B92 does not meet the requirement given in parts j and m, check the adjustment of the Delayed Trigger Level Sensitivity (R920 - Calibration step 4).

✓ 7. Check Delayed and Main Triggering External Level Range.

a. Install the 7A15A Amplifier into the Right Vert compartment of the 7904 oscilloscope.

b. Remove the BNC-T connector and connections from the 7A19 Input and connect it to the 7A15A Input.

c. Set the 7A15A Input Coupling switch to DC and the Volts/Div switch to 1 V.

d. Change the following control settings:

7B92 Time Base

TIME/DIV OR DLY TIME	20 µs
DLY'D Time/Division	10 µs DLY'D SWP Display Mode
Main Triggering	
LEVEL	Adjust for TRIG light on
SLOPE	(+)
TERM	IN - 1MΩ
Delayed Triggering	
SOURCE	EXT
SLOPE	(+)

e. Set the low-frequency sinewave generator for a five division display (5 volts) at 50 kilohertz. Center the display vertically.

✓ f. CHECK - Rotate the Delayed Triggering LEVEL control throughout its range and check that all levels of the positive slope may be obtained (indicates an external delayed trigger level range of at least + and - 2.5 volts). CHECK that display is not triggered at either end of the LEVEL control rotation. (the negative end of the DELAYED TRIGGERING LEVEL does not include the HF SYNC area).

g. Change the Delayed Triggering SOURCE switch to (-).

✓ h. Repeat step f for the negative slope of the waveform.

i. CALIBRATION - If the 7B92 does not meet the requirements given in part f, check the adjustment of the Delayed Trigger Level Sensitivity (R920 - Calibration step 4).

j. Remove the BNC connector from the DLY'D TRIG IN connector and connect it to the MAIN TRIG IN connector.

k. Press the Delayed Triggering LEVEL control to IN - RUNS AFTER DLY TIME, pull out the DLY'D Time/Division switch for the INTEN Display Mode. Set the MAIN TRIGGERING SOURCE switch to EXT.

l. Set the low-frequency sinewave generator for a seven division display at 50 kilohertz. Center the display vertically.

✓ m. CHECK - Rotate the MAIN TRIGGERING LEVEL control throughout it range and check that all levels of the positive slope may be obtained (indicates an external main triggering level range of at least plus and minus 3.5 volts). Check that display is not triggered at either end of the LEVEL control rotation.

n. Change the MAIN TRIGGERING SLOPE switch to (-).

✓ o. Repeat step m for the negative slope of the waveform.

p. CALIBRATION - If the 7B92 does not meet the requirements given in part m, check the adjustment of the Main Trigger Level Sensitivity (R730 - Calibration step 2).

q. Change the MAIN TRIGGERING SOURCE switch to EXT ÷ 10.

r. To check EXT ÷ 10 external level range, apply a 70 volt peak to peak signal through an attenuator, to the 7A15A Input and to the MAIN TRIG IN connector (non-attenuated).

✓ s. CHECK - Rotate the MAIN TRIGGERING LEVEL control throughout its range and check that all levels of the positive slope may be selected (indicates EXT ÷ 10 external main triggering level range of at least plus and minus 35 volts). Check that display is not triggered at either extreme of LEVEL control rotation.

t. Change the MAIN TRIGGERING SLOPE switch to (-).

✓ u. Repeat step s for the negative slope of the waveform.

v. If the 7B92 does not meet the requirements given in part s, check the adjustment of the Main Trigger Level Sensitivity (R730 - Calibration step 2).

✓ 8. Check Main Triggering AC LF REJ Operation.

a. Change the following control settings:

7A15A Amplifier	
Volts/Div	1V
7B92 Time Base	
Main Triggering	
SOURCE	EXT
TIME/DIV OR DLY TIME	10 ms
DLY'D Time/Division	10 ms (press in for NORMAL Display Mode)

b. Set the low-frequency sinewave generator for a three-division display (three volts) at 60 hertz.

c. Rotate the MAIN TRIGGERING LEVEL control for a stable display (TRIG light on).

d. Change the MAIN TRIGGERING COUPLING switch to AC LF REJ.

✓ e. CHECK - Rotate the MAIN TRIGGERING LEVEL control throughout it range and check that a stable display cannot be obtained (TRIG light off).

f. Change the MAIN TRIGGERING SOURCE switch to INT and the COUPLING switch to AC LF REJ.

g. Set the low-frequency sinewave generator for a eight division display at 60 hertz. Center the display vertically.

✓ h. CHECK - Rotate the MAIN TRIGGERING LEVEL control throughout its range and check that a stable display cannot be obtained (TRIG light off).

i. Remove all connections from the oscilloscope system.

✓ 9. Check Line Triggering Operation.

a. Change the following control settings:

7A15A Amplifier	
Volts/Div	5 V
7B92 Time Base	
Main Triggering	
COUPLING	AC
SOURCE	LINE

b. Connect the 10X probe to the 7A15A Input and the probe tip to the same line-voltage source which is connected to the oscilloscope.

✓ c. CHECK - Rotate the MAIN TRIGGERING LEVEL control and check that a stable display can be obtained (TRIG light on) for both the (+) and (-) SLOPE.

d. Remove all connections from the oscilloscope system.

✓ 10. Check AUTO, NORM, and SINGLE SWEEP Modes.

a. Change the following control settings:

7A19 Amplifier	
Volts/Div	1V
7904 Oscilloscope	
Vertical Mode	Left
7B92 Time Base	
Main Triggering	
SOURCE	INT
TIME/DIV OR DLY TIME	10 us
DLY'D Time/Division	10 us (press in for NORMAL Display Mode)

b. Connect the Output of the low-frequency sine-wave generator to the 7A19 Input with a 42-inch 50-ohm BNC cable and BNC T-connector. Connect the output of the T-connector to the MAIN TRIG IN connector with a 42-inch 50-ohm BNC cable. Set the low-frequency generator for a four-division display at 50 kilohertz.

c. Rotate the MAIN TRIGGERING LEVEL control for a free-running display (TRIG light off).

d. Set the MAIN TRIGGERING MODE switch to NORM.

✓ e. CHECK - CRT for no display (TRIG light off).

f. Set the MODE switch to AUTO. Rotate the MAIN TRIGGERING LEVEL to just trigger the display.

g. Set the MODE switch to NORM.

✓ h. CHECK - CRT for triggered display (TRIG light on).

i. Change the MAIN TRIGGERING MODE switch to SINGLE SWEEP.

✓ j. CHECK - CRT for no display.

k. Press the MAIN TRIGGERING RESET button.

✓ l. CHECK - CRT for one sweep as the RESET button is pressed (oscilloscope Intensity may need to be increased to view the single sweep display).

m. Remove the signal from the 7A19 Input, then press the RESET button.

✓ n. CHECK - CRT for no display and READY light on.

✓ o. CHECK - Reconnect the signal to the 7A19 Input. Check for one sweep as the signal is applied to the 7A19 and that the READY light is out after the completion of that sweep.

p. Remove all connections from the oscilloscope system.

✓ 11. Check/Adjust Main Triggering TD Bias and Runs After Sensitivity - (R740, R750 and R959).

a. Remove the 7B92 and plug-in extender from the oscilloscope. Install the 7B92 directly into the B Horiz compartment.

b. Change the following control settings:

Main Triggering	
MODE	AUTO
TIME/DIV OR DLY TIME	.5 ns
DLY'D Time/Division	.5 ns (press in for NORMAL Display Mode)
DELAY TIME MULT	1.00
TERM	OUT - 50
Delayed Triggering	
LEVEL	IN - RUNS AFTER DLY TIME
SLOPE	(+)
COUPLING	AC
SOURCE	INT

c. Connect the Output of the high frequency constant amplitude signal generator to the 7A19 Input with a GR to BNC male adapter, and BNC T-connector. Connect the output of the T-connector to the MAIN TRIG IN connector with a 42-inch 50-ohm BNC cable. Set the high-frequency sinewave generator for a one-division display at 500 megahertz.

✓ d. CHECK - Stable CRT display can be obtained with the MAIN TRIGGERING COUPLING switch Set to AC, AC LF REJ, and DC for both the (+) AND (-) SLOPE. (MAIN TRIGGERING LEVEL control may be adjusted as necessary to obtain a stable display).

e. ADJUST - R740-Main Arming TD Bias counterclockwise until the sweep free-runs, then adjust clockwise until the sweep is triggered. Repeat part c.

f. Change the following control settings:

TIME/DIV OR DLY TIME	.1 μs
DLY'D Time/Division	.5 ns (press in for DLY'D SWP Display Mode)
Main Triggering	
LEVEL	Adjust for TRIG light on.

g. CHECK - Rotate the DELAY TIME MULT dial to 9.00 and check for no double triggering or defocusing of sinewaves.

h. ADJUST - Rotate the DELAY TIME MULT dial from 1.00 to 9.00 and adjust R959 - Runs After Delay Time Sensitivity and R750 - Delaying Sweep Start TD Bias for no double triggering or defocusing.

✓ i. CHECK - Vary the high frequency generator from 500 megahertz to 100 megahertz and from 100 megahertz to 500 megahertz. Check for stable CRT display with no double triggering or defocusing of sinewaves (MAIN TRIGGERING LEVEL control may be adjusted as necessary for a stable display).

j. ADJUST - Vary the high-frequency generator from 500 megahertz to 100 megahertz and from 100 megahertz to 500 megahertz. Repeat the adjustment of R740, R750, and R595 for a stable CRT display with no defocusing or double triggering.

k. INTERACTION - The adjustment of R959 may affect the adjustment of R940 and R950 (Calibration step 12) and R364 (Calibration steps 1 and 27).

1. Change the 7A19 Volts/Div switch to .1 V and set the MAIN TRIG SOURCE switch to EXT.

m. Set the high-frequency generator for a five-division display (500 millivolts) at 500 megahertz.

√ n. CHECK - Stable CRT display can be obtained with the MAIN TRIGGERING COUPLING switch set to AC, AC LF REJ, and DC for both the (+) and (-) SLOPE.

√ o. CHECK - Vary the high-frequency generator from 500 megahertz to 100 megahertz and from 100 megahertz to 500 megahertz. CHECK for stable CRT display with no double triggering or defocusing (MAIN TRIGGERING LEVEL control may be adjusted as necessary for a stable display).

p. CALIBRATION - If the 7B92 does not meet the requirements given in parts m and n, check the adjustments of R740, R750 and R959.

√ 12. Check/Adjust Delayed Triggering TD Bias (R940, R950)

a. Set the high-frequency generator and the 7A19 Volts/Division switch for a one-division display at 500 megahertz.

b. Change the following control settings:

7B92 Time Base

Main Triggering

SOURCE	INT
LEVEL	Adjust for TRIG light on

Delayed Triggering

LEVEL	OUT - DLY'D SWP TRIGGERABLE

c. Rotate the Delayed Triggering LEVEL control for a stable delayed sweep display.

NOTE

If a display cannot be obtained at any setting of the Delayed Triggering LEVEL control, check the preliminary adjustment of R940 and R950 (Calibration step 1) and R950 (Calibration step 4).

✓ d. CHECK - Stable delayed sweep display can be obtained with the Delayed Triggering COUPLING switch set to AC and DC for both the (+) and (-) SLOPE (Delayed Triggering LEVEL control may be adjusted as necessary for a stable display).

e. ADJUST - R950 Delayed Sweep Start TD Bias to observe a slight shift or jump of the delayed sweep trace. Adjust R950 10 degrees clockwise from the observed shift.

f. ADJUST - R940 Delayed Arming TD Bias to remove any double triggering or defocusing from the delayed sweep display.

g. CHECK - Rotate the DELAY TIME MULT dial throughout its range and check for no double triggering or defocusing of sinewaves.

h. INTERACTION - Repeat the adjustment of R940 and R950 as necessary. It may be necessary to check the adjustment of R920 Calibration step 4).

i. Remove the BNC cable from the MAIN TRIG IN connector and connect it to the DLY'D TRIG IN connector.

j. Set the 7A19 Volts/Division switch to .1V. Set the high-frequency generator for a five-division display (500 mV) at 500 megahertz.

k. Change the Delayed Triggering SOURCE switch to EXT.

l. CHECK - Stable delayed sweep display can be obtained with the Delayed Triggering COUPLING switch set to AC and DC for both the (+) and (-) SLOPE (Delayed Triggering LEVEL control may be adjusted as necessary for a stable display).

m. CALIBRATION - If the 7B92 does not meet the requirements given in part 1, check the adjustment of R940 and R950 (Calibration step 12) and R920 (Calibration step 4).

n. Remove all connections from the oscilloscope system.

13. Check HF SYNC Operation.

a. Connect the output of the high-frequency constant amplitude sinewave generator (067-0532-01) to the 7A19 Input with a 5X GR attenuator, GR to BNC male adapter, and BNC T-connector. Connect the output of the T-connector to the MAIN TRIG IN connector with a 42-inch BNC cable.

b. Change the following control settings:

Main Triggering

MODE	HF SYNC
TIME/DIV OR DLY TIME	10 ns
DLY'D Time/Division	10 ns (press in for NORMAL Display Mode)

Delayed Triggering

LEVEL	IN - RUNS AFTER DLY TIME
SLOPE	(+)
COUPLING	DC
SOURCE	INT

c. Set the high-frequency sinewave generator and the 7A19 Volts/Div switch for a 0.5 division display at 100 megahertz.

d. CHECK - Stable CRT display can be obtained with the MAIN TRIGGERING COUPLING switch set to AC, AC LF REJ, and DC (Rotate the MAIN TRIGGERING LEVEL control for optimum display).

e. Set the high-frequency sinewave generator for 0.5 division display at 500 megahertz. Set the TIME/DIV or DLY TIME and DLY'D Time/Division switches to .5 ns (press in DLY'D Time/Division switch for NORMAL Display Mode).

✓ f. CHECK - Repeat part d.

g. Change the following control settings:

7A19 Amplifier	
Volts/Div	.1V
7B92 Time Base	
Main Triggering	
SOURCE	EXT
TIME/DIV OR DLY TIME	10 ns
DLY'D Time/Division	10 ns (press in for NORMAL Display Mode)

h. Set the high-frequency sinewave generator for a one-division display (1 mV) at 100 megahertz.

✓ i. CHECK - Repeat part d.

j. Change the TIME/DIV OR DLY TIME and DLY'D Time/Division switches to .5 ns (press in DLY'D Time/Division switch for the NORMAL Display Mode.

k. Set the high-frequency sinewave generator for a one-division display (100 mV at 500 megahertz.

✓ l. CHECK - Repeat part d.

m. CALIBRATION - If the 7B92 does not meet the requirements given in part d, check the adjustment of R740, R750, and R959 (Calibration step 11).

n. Remove the BNC cable from the MAIN TRIG IN connector and connect it to the DLY'D TRIG IN connector.

o. Change the following control settings:

Main Triggering

SOURCE	INT
LEVEL	Adjust for TRIG light on
TIME/DIV OR DLY TIME	20 ns
DLY'D Time/Division	10 ns (press in for DLY'D SWP Display Mode

p. Set the high-frequency sinewave generator and the 7A19 Volts/Div switch for a 0.5-division display at 100 megahertz. Press and release the Delayed Triggering LEVEL control to DLY'D SWP TRIGGERABLE (knob out).

✓ q. CHECK - Rotate the Delayed Triggering LEVEL control into the HF SYNC area. Check that a stable display can be obtained with the Delayed Triggering COUPLING switch set to AC and DC (Rotate the Delayed Triggering LEVEL control within the HF SYNC area, as necessary for an optimum display).

r. Set the high-frequency sinewave generator for a 0.5 division display at 500 megahertz. Set the TIME/DIV OR DLY TIME switch to .1 us and the DLY'D Time/Division switch to .5 ns (press in the DLY'D Time/Division switch for DLY'D SWP Display Mode).

✓ s. CHECK - Repeat part q.

t. Change the following control settings:

7A19 Amplifier	
Volts/Div	.1 V
7B92 Time Base	
TIME/DIV OR DLY TIME	.1 μs
DLY'D Time/Division	10 ns
Delayed Triggering	
SOURCE	EXT

u. Set the high-frequency generator for a one-division display at 100 megahertz.

✓ v. CHECK - Repeat part q.

w. Set the high-frequency sinewave generator for a one-division display at 500 megahertz. Set the TIME/DIV OR DLY TIME switch to .1 μs and the DLY'D Time/Division switch to .5 ns (press in DLY'D Time/Division switch for the DLY'D SWP Display Mode).

✓ x. CHECK - Repeat part q.

y. CALIBRATION - If the 7B92 Does not meet the requirements given in part d, check the adjustment of R940 and R950 (Calibration step 12).

✓ 14. Check Main and Delayed Trigger Jitter.

a. Change the following control settings:

Main Triggering	
MODE	AUTO
COUPLING	AC
TIME/DIV OR DLY TIME	.5 ns
DLY'D Time/Division	.5 ns (press in for NORMAL Display Mode)
Delayed Triggering	
SOURCE	INT
LEVEL	IN - RUNS AFTER DLY TIME

b. Rotate the MAIN TRIGGERING LEVEL control for a stable display.

✓ c. CHECK - CRT display for less than 0.1 division (50 picoseconds) of jitter. Disregard any slow drift.

d. Change the following control settings:

Main Triggering	
LEVEL	Adjust for stable display
TIME/DIV OR DLY TIME	.1 µs
DLY'D Time/Division	.5 ns (press in for DLY'D SWP Display Mode
Delayed Triggering	
LEVEL	OUT - DLY'D SWP TRIGGERABLE

e. Rotate the Delayed Triggering LEVEL control for a stable delayed sweep display.

✓ f. CHECK - Delayed sweep display for no more than 0.1 division of jitter (50 picoseconds). Disregard any slow drift.

g. Remove all connections from the oscilloscope system.

✓ 15. Check 20 Megahertz Triggering.

a. Change the following control settings:

7A19 Amplifier	
Volts/Div	.2 V
7B92 Time Base	
TIME/DIV OR DLY TIME	50 ns
DLY'D Time/Division	50 ns (press in for NORMAL Display Mode)
Delayed Triggering	
LEVEL	IN - RUNS AFTER DLY TIME

b. Connect the output of the medium frequency constant amplitude signal generator to the 7A19 Input with a GR to BNC female adapter, 42-inch 50-ohm BNC cable and BNC T-connector. Connect the output of the T-connector to the MAIN TRIG IN connector. Set the Type 191 for a 0.5 division (100 mV) display at 20 megahertz.

✓ c. CHECK - Stable CRT display can be obtained with the MAIN TRIGGERING COUPLING switch set to AC, AC LF REJ, and DC for both the (+) and (-) SLOPE (MAIN TRIGGERING LEVEL control may be adjusted as necessary for a stable display).

d. Change the MAIN TRIGGERING SOURCE switch to EXT.

✓ e. CHECK - Repeat part c.

f. CALIBRATION - If the 7B92 does not meet the requirements given in part c, check the adjustment of R730 (Calibration step 2).

g. Remove the BNC cable from the MAIN TRIG IN connector and connect it to the DLY'D TRIG IN connector

h. Change the following control settings:

Main Triggering

SOURCE	INT
LEVEL	Adjust for TRIG light on
TIME/DIV OR DLY TIME	.1 µs
DLY'D Time/Division	50 ns (press in for DLY'D SWP Display Mode)

Delayed Triggering

SOURCE	EXT
LEVEL	OUT - DLY'D SWP TRIGGERABLE

✓ i. CHECK - Stable delayed sweep display can be obtained with the Delayed Triggering COUPLING switch set to AC and DC for both the (+) and (-) SLOPE (Delayed Triggering LEVEL control may be adjusted as necessary for a stable display).

j. Change the Delayed Triggering SOURCE switch to INT.

✓ k. CHECK - Repeat part i.

l. CALIBRATION - If the 7B92 does not meet the requirements given in part i, check the adjustment of R920 (Calibration step 4).

m. Remove all connections from oscilloscope system.

HORIZONTAL SYSTEM CALIBRATION

Equipment Required

1. 7904 Oscilloscope
2. 7A19 Amplifier
3. 7A15A Amplifier
4. 10X probe
5. 7S11 Sampling Unit
6. 7S12 Sampling Unit
7. S1 Sampling Head (two)
8. S52 Pulse Generator Head
9. 284 Pulse Generator
10. Time-mark generator
11. Plug-in extender
12. 42-inch 50-ohm BNC cable (two)
13. GR to BNC female adapter (two)
14. BNC female to BNC female adapter (two)
15. BSM female to BNC female adapter

Control Settings

Set the controls as given in the Preliminary Procedure.

16. Check/Adjust Delayed Sweep Baseline (R452)

a. Install the 7A15A Amplifier unit into the Right Vert Compartment of the 7904 Oscilloscope.

b. Change the following control settings:

7904 Oscilloscope

Vert Mode	Right

7B92 Time Base

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	1 ms (pull out for INTEN Display Mode)

c. To establish a ground reference, set the 7A15A input coupling to Gnd (7A15A installed in Right Vert compartment). Position the trace to start at CRT center with the 7A15A and 7B92 Position controls.

d. Connect a 10X probe from the 7A15A Input to (TP) 462.

e. Set the 7A15A input coupling to DC and adjust the Volts/Div to 50 mV.

f. CHECK - CRT trace must start at CRT center.

g. ADJUST - R452 Dly'd Swp Baseline to start display at CRT center.

h. INTERACTION - The adjustment of R452 may affect the adjustment of R560 (Calibration step 21) and R364 (Preliminary adjustment Calibration step 1).

17. Check/Adjust SWP CAL.

a. Set the 7904 Vertical Mode switch to Left.

b. Connect the marker output of the time-mark generator to the 7A19 Amplifier Input with a 42-inch 50-ohm BNC cable. Set the time-mark generator for one-millisecond markers and adjust the 7A19 Volts/Div switch for about two divisions of display.

c. Rotate the MAIN TRIGGERING LEVEL control for a stable display and rotate the POSITION control to horizontally center the trace.

d. CHECK - CRT display for one-millisecond marker each major division over the center eight divisions of display.

e. ADJUST - Front-panel SWP CAL (screwdriver adjustment R260) for one one-millisecond marker each division over the center eight divisions of display. Use the POSITION control as necessary to horizontally align the display with the vertical graticule lines.

✓ 18. Check Display Modes.

a. Press in the DLY'D Time/Division switch for the NORMAL Sweep Display Mode (TIME/DIV OR DLY TIME and DLY'D Time/Division switch must be pressed in).

✓ b. Rotate the MAIN TRIGGERING LEVEL control for a stable display. Increase the oscilloscope Intensity as necessary. Rotate the DELAY TIME MULT dial and note that it has no effect on the display.

c. Pull out the DLY'D Time/Division switch for the INTEN Display Mode and rotate to .2 ms.

✓ d. CHECK - CRT display for non-intensified trace (delaying sweep) with an intensified portion (delayed sweep). Adjust the 7B92 and oscilloscope Intensity controls for an optimum intensified trace.

✓ e. CHECK - Rotate the DELAY TIME MULT dial and note that the amount of delay time before the intensified portion is controlled by the DELAY TIME MULT dial.

f. Press in the DLY'D Time/Division switch for the DLY'D SWP Display Mode.

g. CHECK - CRT for magnified display (one complete cycle in five divisions). The oscilloscope Intensity may need to be increased to view the delayed sweep display.

h. Press and release the ALT switch for ALT Sweep Display Mode and rotate (TRACE SEP) fully clockwise.

i. CHECK - CRT display for both an intensified trace and a delayed sweep trace. The intensified trace provides an intensified portion on the delaying sweep (delaying sweep rate determined by the TIME/DIV OR DLY TIME switch) during the time that the delayed sweep runs. The delayed sweep trace displays the intensified portion as viewed on the intensified trace at the sweep rate indicated by the DLY'D Time/Division switch.

j. Rotate the TRACE SEP control fully clockwise and check that the intensified trace is positioned approximately four divisions vertically with respect to the delayed sweep trace.

k. Rotate the TRACE SEP control fully counterclockwise and check that the two traces are vertically positioned together. Rotate the TRACE SEP control fully clockwise.

l. Set the oscilloscope Intensity control to midrange.

m. CHECK - Rotate the 7B92 INTENSITY control throughout its range. Check that the brightness of the nonintensified portion, of the intensified trace, can be varied with respect to the intensified portion.

19. Check/Adjust Delay Start and Delay Stop (R402, R350).

a. Change the following control settings:

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	10 us (pull out for INTEN Display Mode)
DELAY TIME MULT	1.00

b. Rotate the TRACE SEP control to separate the intensified and delayed sweep traces. Position the alternate trace display as necessary with the 7A19 Position control. Adjust the 7B92 and oscilloscope Intensity controls for the desired alternate trace display.

NOTE

Rough adjustments of the Delay Start and Delay Stop adjustments will be made by viewing the intensified trace, followed by fine adjustment viewing the delayed sweep trace.

c. CHECK - The intensified sweep starts on the second one-millisecond marker of the intensified trace.

d. ADJUST - R402 Dly Start, to start the intensified sweep on the second one-millisecond marker, then further adjust R402 to start the delayed sweep (delayed sweep trace) at the bottom of the marker.

e. CHECK - Rotate the DELAY TIME MULT dial to 9.00 and check that the intensified sweep starts on the tenth one-millisecond marker.

f. R350 Dly Stop, to start the intensified sweep on the tenth one-millisecond marker, the further adjust R350 to start the delayed sweep (delayed sweep trace) at the bottom of the marker.

g. INTERACTION - Repeat the adjustment of R402 and R350 as necessary. The adjustment of R402 and R350 may affect the adjustment of R340 (Calibration step 23) and R364 (preliminary adjustment, Calibration step 1).

20. Check/Adjust Position and Sweep Registration (R516, R560).

a. Change the following control settings:

Main Triggering

LEVEL	Adjust for stable display
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	1 ms
DELAY TIME MULT	0.00

b. Rotate the TRACE SEP control to position the delaying sweep trace about one-half division above the delayed sweep trace.

c. CHECK - While rotating the POSITION control throughout its range, check for no horizontal shift between traces.

d. ADJUST - R516 Position Registration, for minimum shift between traces.

e. CHECK - First marker of both traces must be aligned.

f. ADJUST - R560 Sweep Registration, to align the first marker of both traces.

g. INTERACTION - Repeat the adjustment of R516 and R560 as necessary. The adjustment of R516 and R560 may affect the adjustment of R452 (Calibration step 16), R523 (Calibration step 22), and R364 (Preliminary adjustment in Calibration step 1, final adjustment in Calibration step 26).

21. Check/Adjust Delaying Sweep Calibration (R511).

a. CHECK - Rotate the POSITION control to view the tenth one-millisecond marker and check that the tenth marker of both traces are aligned.

b. ADJUST - R511 Delaying Sweep Cal, to align the tenth one-millisecond marker of both traces.

c. CHECK - CRT display for both traces horizontally aligned with one one-millisecond marker each graticule division over the center eight graticule divisions.

d. INTERACTION - Repeat the adjustment of R511 and the front-panel SWP CAL adjustment (Calibration step 17) as necessary.

22. Check/Adjust Position Centering (R523).

a. Rotate the front-panel POSITION control fully counter-clockwise.

b. CHECK - That the second one-millisecond marker starts on the first graticule line.

c. ADJUST - R523 to position the second one-millisecond marker on the first graticule line.

d. CHECK - Rotate the POSITION control fully clockwise and check that the display can be positioned to the right of graticule center.

23. Check/Adjust Delaying and Delayed Sweep Length (R340, R465).

a. Set the time-mark generator for one-millisecond and .1 millisecond markers.

b. Adjust the MAIN TRIGGERING LEVEL control to trigger both traces on the one-millisecond markers.

c. Rotate the TRACE SEP control fully clockwise and rotate the POSITION control to place the second one-millisecond marker on the first graticule line.

d. CHECK - Delayed sweep trace for sweep length of 10.4 divisions (within 0.3 divisions) as shown by one to seven 0.1 millisecond markers to the right of the tenth vertical graticule line. The lower trace is the delaying sweep trace.

e. ADJUST - R465 Delayed Sweep Length for four 0.1 millisecond markers to the right of the tenth graticule line.

f. CHECK - Delaying sweep trace for sweep length of 10.4 divisions (within 0.3 divisions as shown by one to seven 0.1 millisecond markers to the right of the tenth vertical graticule line. The upper trace is the delaying sweep trace.

g. ADJUST - R340 Delaying Sweep Length, for four 0.1 millisecond markers to the right of the tenth graticule line.

h. INTERACTION - Repeat the adjustment of R340 and R465 as necessary. Check the adjustment of R402 (Calibration step 19) and R452 (Calibration step 16).

24. Check/Adjust Delayed Sweep 20 Nanosecond Timing (C449).

a. Set the time-mark generator for 20 nanosecond markers.

b. Change the following control settings:

TIME/DIV OR DLY TIME	20 ns
DLY'D Time/Division	20 ns (press in for NORMAL Display Mode)
Main Triggering	
LEVEL	Adjust for stable display

c. CHECK - Delayed sweep trace (lower trace) for one complete cycle each graticule division over the center eight divisions.

d. ADJUST - C449 for one complete cycle each graticule division over the center eight divisions of the delayed sweep trace.

25. Check/Adjust One-Microsecond Timing (C414, C443).

a. Set the time-mark generator for one-microsecond markers.

b. Change the following control settings:

TIME/DIV OR DLY TIME	1 us
DLY'D Time/Division	1 us (press in for NORMAL Display Mode)
Main Triggering	
LEVEL	Adjust for a stable display

c. CHECK - Delayed sweep trace (bottom trace) for one one-microsecond marker each graticule division.

d. ADJUST - C443 Delayed One-Microsecond Timing, for one one-microsecond marker each graticule division of the delayed sweep trace (bottom trace).

e. CHECK - Delaying sweep trace (upper trace) for one one-microsecond marker each graticule division.

f. ADJUST - C414 Delaying One-Microsecond Timing for one one-microsecond marker each graticule division of the delaying sweep trace (upper trace).

g. INTERACTION - Repeat the adjustment of C443, C414, and C449 as necessary.

26. Check/Adjust Delay Pickoff TD Bias (R364).

a. Set the time-mark generator for 2 nanosecond markers.

b. Change the following control settings:

DELAY TIME MULT	Fully counterclockwise
TIME/DIV OR DLY TIME	.1 μs
DLY'D Time/Division	2 ns (press in for DLY'D SWP Display Mode)
POSITION	Fully clockwise

c. Set the 7A19 Volts/Div switch for approximately two divisions of display.

d. Rotate the MAIN TRIGGERING LEVEL control to trigger the display near the zero volt level. Do not change this LEVEL control setting.

e. Disconnect the time-mark signal from the 7A19 Input.

f. Connect the Pulse Output of the Type 284 Pulse Generator to the 7A19 Input with a GR to BNC female adapter and 42-inch, 50-ohm BNC cable. Set the Type 284 for a lead time of 5 nanoseconds.

g. Set the 7A19 Volts/Div switch for approximately two divisions of display.

h. CHECK - CRT display for leading edge of pulse on the eight vertical graticule line.

i. ADJUST - R364, Delay Pickoff TD Bias, fully counterclockwise. Then adjust clockwise until the leading edge of the pulse is on the

26. Check/Adjust Delay Pickoff TD Bias (R364). (cont)

eighth vertical graticule line. If R364 is adjusted fully clockwise and the leading edge of the pulse is not at the eighth vertical graticule line, adjust R364 counterclockwise to move the pulse one nanosecond.

j. Disconnect the pulse from the 7A19 Input.

27. Check/Adjust High-Frequency Linearity (C557, C565, C572).

a. Remove the 7A19 and 7A15 Amplifier units from the 7904 Oscilloscope and the 7B92 from the plug-in extender.

b. Install the 7S11 Sampling Unit (with S1 Sampling Head) into the Left Vert compartment of the 7904 Oscilloscope. Install the 7S12 TDR/Sampler (with S1 Sampling Head and S-54 Pulse Generator Head) into the center two compartments of the 7904 Oscilloscope.

c. Disconnect the BNC cables from connectors A 11 and B 11 of the 067-0589-00 plug-in extender, installed in the B Horiz compartment of the 7904 Oscilloscope (it is necessary to remove the extender from the oscilloscope).

d. Connect the + and - outputs of the 7B92 (plug-in extender cables A 11 and B 11) differentially to the sampling system inputs. Specifically, connect the + signal from plug-in extender cable A 11 to the 7S12 Input (by way of S1 Sampling Head) with a BNC female-to-female adapter, 42-inch BNC cable, and BNC female-to-GR adapter. Connect the - signal from plug-in extender into the B Horiz compartment of the 7904 Oscilloscope. Connect a

27. Check/Adjust High-Frequency Linearity. (cont)

42-inch BNC cable, with BSM female-to-BNC female adapter from the S-54 Pretrig out connector (S-54 pulse generator head is installed in the 7S12 TDR Sampler) to the 7B92 MAIN TRIG IN connector.

e. Change the following control settings:

7904 Oscilloscope

Vertical MODE	Add
Horizontal Mode	A

7B92 Time Base

Main Triggering

SOURCE	EXT
TIME/DIV OR DLY TIME	.1 µs
DLY'D Time/Division	50 ns (press in for DLY'D SWP Display Mode)

7S11 Sampling Unit

+ Up/Invert	Invert
mVolts/Div	100
Variable	Cal In
Dot Response	Normal

7S12 TDR/Sampler

mV/mp (pushbuttons)	mV
mVolts/Div	100
Variable Volts/Div	Cal In
Time/Div	.1 µs
REP (pushbutton)	(Press in for repetitive scan display)

27. Check/Adjust High-Frequency Linearity. (cont)

f. Rotate the 7B92 Main Triggering LEVEL control for the TRIG light on.

g. Rotate the 7S11 and 7S12 DC Offset controls to vertically position the display on the CRT.

h. Set the 7904 Vertical Mode to Chop. Rotate the 7S11 and 7S12 DC Offset controls and the 7S11 Delay control to position both traces together.

i. Repeat steps g and h until the display is vertically positioned on the CRT when the 7904 is in the Add Vertical Mode, and both traces are positioned together when the 7904 is in the Chop Vertical Mode.

j. Set the 7904 Vertical Mode to ADD.

k. Press and release the 7S12 Time/Division Variable control for variable sweep rates, and adjust for a ramp display of five vertical divisions in five horizontal divisions. Rotate the DELAY TIME MULT dial to approximately midrange and rotate the 7S12 Time Distance control to horizontally position the trace.

NOTE

The sampling system display is now calibrated to the 50 nanosecond sweep rate of the 7B92 under calibration. Do not change the 7S12 Time/Div Variable and Time Distance control.

27. Check/Adjust High-Frequency Linearity. (cont)

1. Change the following control settings:

7B92 Time Base

TIME/DIV OR DLY TIME	.1 μs
DLY'D Time/Division	2 ns (press in for DLY'D SWP Display Mode)

7S11 Sampling Unit

m Volts/Div	200

7S12 Sampling Unit

mVolts/Div	200
Time/Div	10 ns

n. Rotate the 7B92 DELAY TIME MULT dial to horizontally position the trace.

o. CHECK - CRT display for a smooth and linear ramp with slight preshoot (see Fig. 4 for typical display).

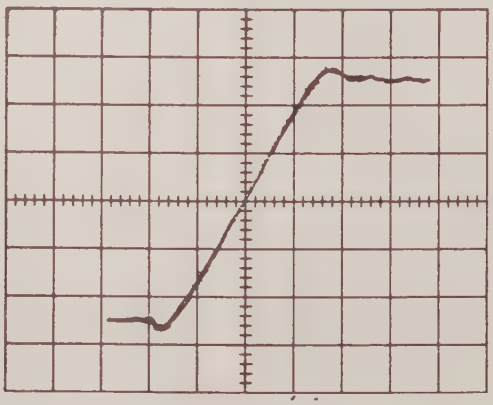

Fig. 1

27. Check/Adjust High-Frequency Linearity. (cont)

p. ADJUST - C557, Sweep Linearity, for peak amplitude on leading edge, C565 and C572 for a slight preshoot with as smooth and linear ramp as possible.

q. INTERACTION - Repeat the adjustment of C557, C565, and C572 as necessary.

28. Check/Adjust Two-Nanosecond Timing (R244).

a. Set the 7S11 and 7S12 mVolts/Div switches to 100 mVolts and set the 7S12 Volts/Div switch to 5 ns.

b. CHECK - CRT for ramp display with five vertical divisions in four horizontal divisions. Rotate the 7B92 DELAY TIME MULT dial to horizontally position the trace.

c. ADJUST - R244, Two-Nanosecond Timing, for ramp display with five vertical divisions in four horizontal divisions.

29. Check/Adjust One-Nanosecond Timing (R246).

a. Set the 7S12 Time/Div switch to 2 ns.

b. Set the 7B92 DLY'D Time/Division switch to 1 ns.

c. CHECK - CRT for ramp display with five vertical divisions in five horizontal divisions.

29. Check/Adjust One-Nanosecond Timing (R246). (cont)

d. ADJUST - R246, One-Nanosecond Timing, for ramp display with five vertical divisions in five horizontal divisions. Rotate the 7B92 POSITION control to horizontally position the trace.

30. Check/Adjust 0.5 Nanosecond Timing (R567).

a. Set the 7B92 DLY'D Time/Division switch to .5 ns.

b. CHECK - CRT for ramp display with five vertical divisions in 2.5 horizontal divisions.

c. ADJUST - R567, 0.5 Nanosecond Timing, for ramp display with five vertical divisions in 2.5 horizontal divisions. Horizontally position the display as necessary with the 7B92 DELAY TIME MULT dial.

d. Repeat the adjustment of R244, R246, and R567 as necessary. If R567 cannot be adjusted for five vertical divisions in 2.5 horizontal divisions, readjust C565 and C572 (Calibration step 27).

31. Check/Readjust High-Frequency Timing (R244, R246, R567).

a. Remove all connections and plug-in units from the 7904 Oscilloscope.

b. Install the 7A19 Amplifier directly into the Left Vert compartment of the 7904 Oscilloscope and the 7B92 Time Base directly into the B Horiz compartment.

31. Check/Readjust High-Frequency Timing (R244, R246, R567). (cont)

c. Connect the output of the time-mark generator to the 7A19 Input with a 42-inch, 50-ohm BNC cable. Set the time-mark generator for 2 ns markers.

d. Change the following control settings:

7904 Oscilloscope

Vertical Mode	Left Vert
Horizontal Mode	B

7B92 Time Base

Main Triggering

SOURCE	INT
LEVEL	Adjust for stable display

e. Adjust the 7A19 Volts/Division switch for about two divisions of display. Adjust the 7B92 and oscilloscope Intensity controls as necessary.

NOTE

Checks, for readjustment of timing, must be made with the 7B92 installed directly into the oscilloscope. Adjustment of R567 can be made by reaching into the center two compartments of the oscilloscope (be certain that the 7A19 side covers are). R244 and R246 can be adjusted through the top plug-in housing or by removing the 7B92 from the oscilloscope.

31. Check/Readjust High-Frequency Timing (R244, R246, R567). (cont)

f. CHECK - CRT display for two complete cycles over the center eight graticule divisions.

g. ADJUST - R567, .5 ns Timing, for two complete cycles over the center eight graticule divisions.

h. Change the DLY'D Time/Division switch to 1 ns.

i. CHECK - CRT display for one complete cycle in two graticule divisions.

j. ADJUST - R246, 1 ns Timing, for one complete cycle in two graticule divisions.

k. Change the DLY'D Time/Division switch to 2 ns.

l. CHECK - CRT display for one complete cycle each division over the center eight divisions of the graticule.

m. ADJUST - R244 for one complete cycle each division over the center eight divisions of the graticule.

✓ 32. Check Delaying and Delayed Sweep Timing Accuracy.

NOTE

The tolerances in steps 32 and 33 are for an ambient temperature range of +15°C to +35°C. If outside this range, see Specifications in the 7B92 Operator's Manual for applicable tolerances.

a. Connect the time-mark generator output to the 7A19 Input with a 42-inch 50-ohm BNC cable.

b. Change the following control settings:

ALT	OUT (TRACE SEP fully clockwise)
DELAY TIME MULT	0.00

c. Set the 7B92 and oscilloscope INTENSITY controls for an optimum ALT Sweep Display.

d. CHECK - Using the Time/Division switch settings and the time-mark generator settings given in Table 3-1, check delaying and delayed sweep timing to the tolerances given in Table 3-1. Make timing checks in the NORMAL Sweep Display Mode. The upper trace is the delaying sweep trace and the lower trace is the delayed sweep trace.

TABLE 3-1

Delaying and Delayed Sweep Timing

TIME/DIV OR DLY TIME	DLY'D Time/Division	Time-Markers	CRT Display (markers/division)	Tolerance (+15° C to +35° C)	
				Delaying Sweep	Delayed Sweep
.2 s	.2 s	.1 s	2	±0.32 div	±0.32 div
.1 s	.1 s	.1 s	1		
50 ms	50 ms	50 ms	1		
20 ms	20 ms	10 ms	2		
10 ms	10 ms	10 ms	2		
5 ms	5 ms	5 ms	1		
2 ms	2 ms	1 ms	2		
1 ms	1 ms	1 ms	1		
.5 ms	.5 ms	.5 ms	1		
.2 ms	.2 ms	.1 ms	2		
.1 ms	.1 ms	.1 ms	1		±0.24 div
50 µs	50 µs	50 µs	1	±0.24 div	
20 µs	20 µs	10 µs	2		
10 µs	10 µs	10 µs	1		
5 µs	5 µs	5 µs	1		
2 µs	2 µs	1 µs	2		
1 µs	1 µs	1 µs	1		
.5 µs	.5 µs	.5 µs	1		
.2 µs	.2 µs	.1 µs	2		
.1 µs	.1 µs	.1 µs	1		
50 ns	50 ns	50 ns	1		
20 ns	20 ns	20 ns	1		±0.32 div (Exclude the first 2 div of delayed sweep)
10 ns	10 ns	10 ns	1		
	5 ns	5 ns	1		
	2 ns	2 ns	1		
	1 ns	2 ns	1 cycle/div		±0.32 div (Exclude the first 5 div of delayed sweep)
	.5 ns	2 ns	1 cycle/4 div		±0.4 div (Exclude the first 10 divisions of delayed sweep

e. CALIBRATION - If the 7B92 does not meet the requirements given in part d, check the adjustment of the front-panel SWP CAL (Calibration step 17) and R511 (Calibration step 21). If the adjustment of R511 and the front-panel SWP CAL does not correct the 7B92 timing accuracy, check Calibration steps 24 through 31.

33. Check Delaying and Delayed Sweep Linearity.

a. Change the following control settings:

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	1 ms (Pull out for INTEN Display Mode)
ALT	IN

b. Set the time-mark generator for one-millisecond markers. Center the display vertically.

c. Position the second marker to the second graticule line.

d. CHECK - Fourth marker is within 0.1 division (5%) of the fourth graticule line.

e. Position the third marker to the third graticule line.

f. CHECK - Fifth marker is within 0.1 division (5%) of the fifth graticule line.

g. CHECK - Continue linearity check for each two division portion of the sweep within the center eight divisions of display.

h. Change the TIME/DIV OR DLY TIME and DLY'D Time/Division switches to 10 ns (INTEN Display Mode). Set the time-mark generator for 10 nanosecond markers.

✓ i. Using the procedure outlined in steps c through g, check that delaying sweep linearity is with 0.2 division (10%).

j. Set the TIME/DIV OR DLY TIME and DLY'D Time/Division switches to 1 ms (press in DLY'D Time/Division switch for NORMAL Sweep Display Mode). Set the time-mark generator for one-millisecond markers.

✓ k. Using the procedure outlined in steps c through g, check that delayed sweep linearity is within 0.1 division (5%).

l. Set the TIME/DIV OR DLY TIME and DLY'D Time/Division switches to 10 ns (press in DLY'D Time/Division for NORMAL Sweep Display Mode). Set the time-mark generator for ten nanosecond markers.

✓ m. Using the procedure outlined in steps c through g, check that delayed sweep linearity is within 0.2 division (10%).

n. Set the TIME/DIV OR DLY TIME and DLY'D Time/Division switches to 2 ns (press in DLY'D Time/Division switch for NORMAL Sweep Display Mode). Set the time-mark generator for two nanosecond markers.

✓ o. Using the procedure outlined in steps c through g, check that delayed sweep linearity is within 0.2 division (10%). Exclude the first two divisions of delayed sweep.

✓ 34. Check Delaying and Delayed Sweep Variable Control Range.

a. Set the time-mark generator for ten-microsecond markers.

b. Change the following control settings:

TIME/DIV OR DLY TIME	2 µs
DLY'D Time/Division	2 µs (pull out for INTEN Display Mode)
Variable Time/Division Selector (P110)	Set for Delaying Sweep Variable (see Operator Manual)

c. Adjust the MAIN TRIGGERING LEVEL control for a stable display. Press and release the VARIABLE Time/Division control for variable delaying sweep rates.

✓ d. CHECK - Rotate the VARIABLE control fully counter-clockwise. Check CRT display for no more than 2 major divisions between ten-microsecond markers. (This indicates continuously variable sweep rates between calibrated steps).

e. Set the Variable Time/Division Selector for variable delayed sweep rates. Press in the DLY'D Time/Division switch for the DLY'D SWP Display Mode.

✓ f. Repeat part d.

✓ 35. Check Differential Delay Time Accuracy.

a. Set the time-mark generator for .1 s markers.

b. Change the following control setting:

TIME/DIV OR DLY TIME	.2 s
DLY'D Time/Division	2 ms
ALT	OUT - (Rotate fully clockwise)

c. Rotate the MAIN TRIGGERING LEVEL control for a stable display. Set the 7B92 and oscilloscope Intensity controls for optimum alternate display.

✓ d. Set the DELAY TIME MULT dial near 1.00 and adjust until the second marker starts at the beginning of the delayed sweep. The delayed sweep trace (lower trace) provides the best indication of the sweep starting point while the intensified trace (upper trace) indicates which marker the sweep starts on. Note the DELAY TIME MULT dial reading. Set the DELAY TIME MULT dial near 9.00 and adjust the dial until the length marker starts at the beginning of the delayed sweep. Note the DELAY TIME MULT dial reading. The difference must be no greater than 8.00 plus the ± 10 minor dial division (± 0.20 DELAY TIME MULT dial reading).

✓ e. CHECK - Using the procedure given in part d, and the Time/Division and time-mark generator settings given in Table 3-2 check that delay time accuracy is within the tolerance given in Table 3-2.

TABLE 3-2

Differential Delay Time Accuracy

TIME/DIV OR DLY TIME Switch	DLY'D Time/ Division Switch	Time/Mark Generator Setting	Allowable Error
.2 s	2 ms	.1 s	± 10 minor dial divisions (±0.20 DELAY TIME MULT dial reading)
.1 s	1 ms	.1 s	
50 ms	.5 ms	50 ms	
20 ms	.2 ms	10 ms	
10 ms	.1 ms	10 ms	
5 ms	50 µs	5 ms	
2 ms	20 µs	1 ms	
1 ms	10 µs	1 ms	
.5 ms	5 µs	.5 ms	
.2 ms	2 µs	.1 ms	
.1 ms	1 µs	.1 ms	
50 µs	.5 µs	50 µs	
20 µs	.2 µs	10 µs	± 6 minor dial divisions (±0.12 DELAY TIME MULT dial reading)
10 µs	.1 µs	10 µs	
5 µs	50 ns	5 µs	
2 µs	20 ns	1 µs	
1 µs	10 ns	1 µs	
.5 µs	5 ns	.5 µs	
.2 µs	2 ns	.1 µs	
.1 µs	1 ns	.1 µs	
50 ns	.5 ns	50 ns	± 13 minor dial divisions (±0.26 DELAY TIME MULT dial reading)
20 ns	.5 ns	20 ns	
10 ns	.5 ns	10 ns	

✓ 36. Check Absolute Delay Time Accuracy.

a. Press and release the ALT button for the ALT Sweep Display Mode and rotate the TRACE SEP control fully clockwise.

✓ b. CHECK - Using the TIME/DIV OR DLY TIME switch, DLY'D Time/Division switch, and time-mark generator settings given in Table 3-3, check absolute delay time accuracy. Adjust the 7A19 Volts/Division switch for approximately a two-division display of each trace. Set the DELAY TIME MULT dial to 1.00 and check that the delayed sweep starts at the beginning of the second marker within the tolerances given in Table 3-3. The delayed sweep trace (lower trace) provides the best indication of the sweep starting point while the intensified trace indicates the marker on which the sweep starts.

✓ 37. Check Delay Time Multiplier Incremental Linearity.

a. Set the time-mark generator for one millisecond marker.

b. Change the following control settings:

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	10 µs

c. Adjust the MAIN TRIGGERING LEVEL control for a stable display. Adjust the 7B92 and oscilloscope Intensity controls for optimum ALT Sweep display.

d. Set the DELAY TIME MULT dial to 9.00; then rotate the dial slightly so a marker is displayed at the start of the sweep. The delayed sweep trace (lower trace) provides the best indication of the sweep start-

TABLE 3-3

ABSOLUTE DELAY TIME MEASUREMENT

TIME/DIV OR DLY TIME Switch	DLY'D Time/ Division Switch	Time-Mark Generator Setting	Allowable Error
.2 s	2 ms	.1 s	± 8 minor dial divisions (0.16 DELAY TIME MULT dial reading)
.1 s	1 ms	.1 s	± 7.5 minor dial divisions (0.15 DELAY TIME MULT dial reading)
50 ms	.5 ms	50 ms	
20 ms	.2 ms	10 ms	
10 ms	.1 ms	10 ms	
5 ms	50 µs	5 ms	
2 ms	20 µs	1 ms	
1 ms	10 µs	1 ms	
.5 ms	5 µs	.5 ms	
.2 ms	2 µs	.1 ms	
.1 ms	1 µs	.1 ms	
50 µs	.5 µs	50 µs	
20 µs	.2 µs	10 µs	
10 µs	.1 µs	10 µs	
5 µs	50 ns	5 µs	
2 µs	20 ns	1 µs	
1 µs	10 ns	1 µs	
.5 µs	5 ns	.5 µs	± 8.5 minor dial divisions (0.17 DELAY TIME MULT dial reading)
.2 µs	2 ns	.1 µs	± 10 minor dial divisions (0.20 DELAY TIME MULT dial reading)
.1 µs	1 ns	.1 µs	± 12.5 minor dial divisions (0.25 DELAY TIME MULT dial divisions)
50 ns	.5 ns	50 ns	± 13 minor dial divisions (± 0.26 DELAY TIME MULT dial divisions)
20 ns	.5 ns	20 ns	± 16 minor dial divisions (0.32 DELAY TIME MULT dial reading)
10 ns	.5 ns	10 ns	±21 minor dial divisions (±0.42 DELAY TIME MULT dial reading)

37. Check Delay Time Multiplier Incremental Linearity (cont).

ing point while the intensified trace indicates which marker on which the sweep starts.

e. Note the exact DELAY TIME MULT dial reading; the difference between this reading and 9.00 is the basic dial error to be used in checking linearity.

f. Set the DELAY TIME MULT dial to 8.00; then rotate the dial slightly so a marker is displayed at the start of the sweep.

✓ g. CHECK - The DELAY TIME MULT dial must read 8.00 ± 0.8 minor dial division (0.016 DELAY TIME MULT dial reading).

✓ h. Repeat the preceding check at each major dial division between 8.00 and 1.00.

i. Set the time-mark generator for .1 microsecond markers.

j. Change the following control settings:

TIME/DIV OR DLY TIME	.1 µs
DLY'D Time/Division	1 ns

✓ k. Repeat parts c through h.

l. Set the time-mark generator for 10 nanosecond markers.

m. Change the following control settings:

TIME/DIV OR DLY TIME	10 ns
DLY'D Time/Division	0.5 ns